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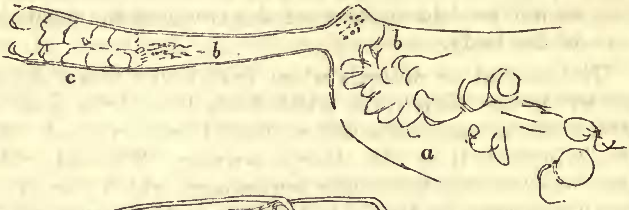

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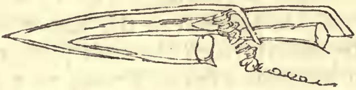

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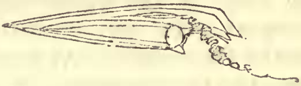

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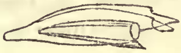

Fig. 1. A highly magnified view of the base of the tentacular appendage and part of the nutritive organ. *b, b.* Groups of opake particles in motion at these places, the circulation going on throughout the divisions of the oblong vessel *c.*

Fig. 2. The two animals united, as first taken.

Fig. 3. The larger individual with the tentacular appendage.

Fig. 4. The smaller individual.

When viewed under a lens, the ridges of the body are seen to be serrated along the edge.

XXI.—*Report of the Results of Researches in Physiological Botany made in the year* 1839. By F. J. Meyen, M.D., Professor of Botany in the University of Berlin*.

[Continued from vol. vi. p. 429.]

M. Unger, in a treatise on the organs of fructification of *Riccia glauca*†, has made a few but very important remarks on the present question concerning the sexuality of Phanero-

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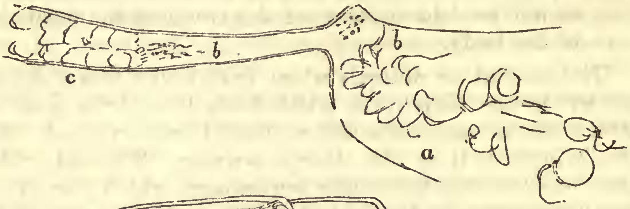

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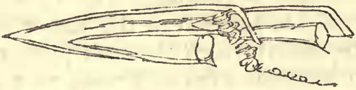

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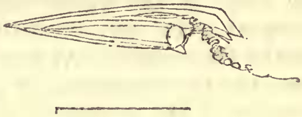

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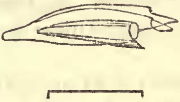

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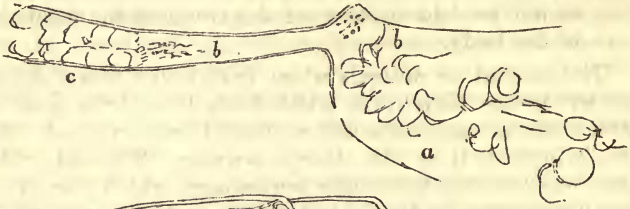

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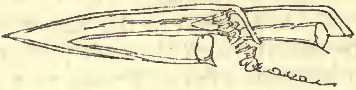

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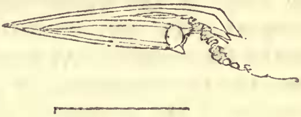

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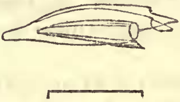

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gamous plants. His researches on the stigma are by no means favourable to the theory of M. Endlicher, according to which the moisture of the stigma is the fertilizing substance; and he moreover states, that there is just as little foundation for the theory of M. Schleiden, according to which the embryo-sac effects the fertilization. M. Unger gives the question quite another direction, and one which, as he believes, corresponds better with the nature of the subject. He says: What important objection could be made to the supposition, that the pollen grains, when they arrive on the stigma, are already fecundated? Does not analogy lead us to suppose that their formation is a work of fertilization? In this case, the male organs of plants must be sought in the anthers or the neighbouring parts, etc. M. Bernhardi * has expressed new doubts concerning the general idea, that the formation of the seed, in Phanerogamic plants, depends solely and alone upon sexual contact; he brings forward observations which are unfavourable both to the old and the new theory of fecundation. Bernhardi calls the followers of the old theory the Animalculists, and those of the new, who seek the germ of the future plant in the contents of the pollen, the Pollenists. Against the doctrines of the Pollenists he brings forward the observations of Gærtner, namely, that many seed-bearing hybrids, by being continually grown from seeds, return into the primitive form; for this cannot be otherwise explained than by the assumption that in this case the female parent had a greater share in the formation of the embryo than the male. The only means of escape left for the Pollenists, is to ask whether these observations are quite correct or not. The most important part of M. Bernhardi's work, however, treats of the observations, according to which seeds perfectly capable of germinating have been formed in the ovaries of several plants without previous contact with pollen; in this case, therefore, the female alone was sufficient for the formation of the seeds: the observations of different botanists are here mentioned, and moreover, in order to render such a production less incredible, many statements—according to which animals, as insects, salamanders, etc., have produced young without previous fecundation—are brought forward. The numerous experiments which M. Bernhardi has made with all possible care with the hemp plants, and their results, are circumstantially described. In April 1811 he sowed thirty seeds, and obtained twenty-one plants, nine male, twelve female. From

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two female plants which were allowed to stand he obtained twenty-eight seeds, which, sowed in 1812, produced twenty plants, ten male and ten female. Two of these females produced twenty seeds, and from these were obtained, in 1813, fifteen plants, eight male, seven female. From these, thirty seeds were produced, which gave, in 1814, nineteen plants, twelve male, seven female; and thirty-two seeds from these produced, in 1815, twenty-one plants, sixteen male, five female; only two of these females were allowed to stand, from which were obtained twenty-five seeds, which produced, in 1816, fifteen male and two female plants. In these experiments the male plants were destroyed in a very early stage, while they had perfectly undeveloped anthers; only two females were allowed to remain, in order that it might be easier seen whether some male flowers had not been produced between the female ones. The most curious result of these observations is, the formation of mature seeds without fecundation, for this could not be observed; and moreover it is very remarkable, *that the proportion of male plants to the female ones increased regularly*: the plants were cultivated on a rather poor soil. As far as concerns the first result, I consider that it is by no means proved by these new observations, that in the case of the hemp plant, or other Phanerogams, seeds are produced without fecundation; it may be asked whether these experiments are perfectly correct. However, observations made by such trustworthy men as M. Bernhardi cannot be put aside without sufficient reasons, and it is therefore advisable that these experiments be repeated next summer with all the care which such a subject requires. I have observed the formation of pollen in such very unusual places in other plants, that something similar might perhaps be supposed to take place in the cases above mentioned.

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In consequence of this junction, in which the act of fecundation consists, there is formed at the summit of the embryo-sac, directly under the point of junction, a little bladder, the so-called germinal vesicle (Keimbläschen), from which the suspensor and the embryo-bladder are produced, which is described and delineated. I never saw a larger embryo-sac than in this *Mesembryanthemum*, in which the ovulum is half curved, and is twisted back by a bend in the umbilical cord. In the case of *M. linguæforme*, the junction of the pollen-tube with the embryo-sac takes place exactly at the extremity; and after the germ-bladder is formed, the end of the pollen-tube enlarges considerably, and remains so for a very long time; while in perfectly similar species the pollen-tube disappears directly after fertilization, etc.

M. Decaisne* has laid before the Academy of Paris a very interesting research on the development and structure of the flowers of *Viscum album*, and MM. Mirbel, Jussieu, and Ad. Brongniart have given a report of the results, of which we can here mention only the most important.

The cells of the anthers and of the calyx-leaves, with which the former are grown together, do not exhibit in their form any difference, except that the latter are filled with a green substance, whereas the former are colourless. Five

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months before blossoming the cellular tissue of the anthers is uniform, and is divided into small cavities with green sides or walls. These cavities increase, and their cellular contents vanish in order to make room for other cells of large size, which are called "les utricules polliniques" (so-called primitive or mother-cells, Mutterzellen), and for one or two nuclei mixed with an infinite number of very small globules; the nuclei are the commencement of the pollen-grains; these "utricules" thicken, become opake, and exhibit concentric, more or less regular, layers in their circumference; and finally in each tube (Mutterzelle! M.) there are enclosed four yellowish nuclei, which are more or less rounded, and have in the centre a bright spot. Afterwards, the substance which caused the thickening of the "utricules polliniques" deposits itself between each of the four nuclei which were contained therein, and produces cavities having the form of the nuclei (this is the formation of the special primitive cells, Specialmutterzellen, M.); and finally this substance disappears, and the pollen-grains are found lying free in the cavity of the anther. In this matured state they exhibit small papillæ on their surface; and when the nucleus which they previously contained has disappeared, an inner membrane is also to be seen. The anthers of *Viscum album* do not possess those retiform cells which are seen in so many other plants.

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* Dévelopement du pollen dans le Gui; changemens que présentent ses ovules et ceux du Thesium.—Comptes Rendus de 1839, 11 Fevrier, p. 201. —[Translated in the Annals of Natural History for May 1841, p. 185.—Ed.]

From the first appearance of the flower, the ovarium, as well as the anthers, coheres with the calyx, and it consists of a green, uniform, cellular mass, in which no cavities are to be distinguished. Some time after the blossoming one observes two small holes, which are formed in the circumference of the ovarium, and in the centre of the cellular tissue. After fertilization these cavities increase, and on their junction they represent the cavity of the endocarpium. In Paris the Misseltoe blossoms in March or April, and the ovulum appears at the end of May or in the beginning of June. About this time it makes its appearance as a pulpy wart, fastened to the base of the endocarpium; it is generally accompanied by two fine filaments, which are the rudiments of two abortive ovula.

As no ovulum-tunics (eyhüllen) were observed, M. Decaisne concludes that the ovulum is here in its simplest form, and consists solely of a nucleus; but from observations I have made, it is evident that the embryo-sac, with the contained albuminous body and the embryo, were mistaken for the naked ovulum or simple nucleus: the following statements are therefore to be corrected; the proofs of the above will appear hereafter in a research by myself. The report

months before blossoming the cellular tissue of the anthers is uniform, and is divided into small cavities with green sides or walls. These cavities increase, and their cellular contents vanish in order to make room for other cells of large size, which are called "les utricules polliniques" (so-called primitive or mother-cells, Mutterzellen), and for one or two nuclei mixed with an infinite number of very small globules; the nuclei are the commencement of the pollen-grains; these "utricules" thicken, become opake, and exhibit concentric, more or less regular, layers in their circumference; and finally in each tube (Mutterzelle! M.) there are enclosed four yellowish nuclei, which are more or less rounded, and have in the centre a bright spot. Afterwards, the substance which caused the thickening of the "utricules polliniques" deposits itself between each of the four nuclei which were contained therein, and produces cavities having the form of the nuclei (this is the formation of the special primitive cells, Specialmutterzellen, M.); and finally this substance disappears, and the pollen-grains are found lying free in the cavity of the anther. In this matured state they exhibit small papillæ on their surface; and when the nucleus which they previously contained has disappeared, an inner membrane is also to be seen. The anthers of *Viscum album* do not possess those retiform cells which are seen in so many other plants.

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proceeds thus: When the seeds of *Viscum* contain more than one embryo, it is to be explained by the development or cohesion of two ovula, of which one is generally abortive, etc. The green vascular covering which is seen on the ripe seed, constitutes, according to M. Decaisne, a part of the fruit, and is the endocarp. This will however be seen to be incorrect.

M. Schleiden* has published some remarks on the flowers of the Loranthaceæ, and particularly of *Viscum album*; he draws attention to the fact that this form of flower is probably the simplest which can exist, for it consists of two pairs of leaves placed in a circle, which in the male flowers are metamorphosed into anthers, and in the females have more the nature of a calyx. Between these sits the straight, naked nucleus, and the embryo-sac is said to be formed in the pith of the stalk (pedunculus). The grains of pollen appear on the top of the nucleus, enter into it several together, and thus produce the Polyembryony. M. Schleiden considers the berry to be the pedunculus, which has become succulent, and whose tissue is metamorphosed into that harder and firmer kind which forms the skins of the seeds. The regular form of the anthers of *Viscum album* is usually bilocular and four-celled, but each cell is divided into several compartments by partitions, and regular anthers seldom occur on account of monstrosity. In *Viscum verticillatum* the spike consists of three pairs of bracts; the upper pair has only one flower, and each of the others three, which afterwards form a "*Verticillus spurius*," while the end flower is wanting. In *Loranthus* the point of the naked nucleus is lengthened so as to assume the appearance of a style. At the end M. Schleidan observes, that the Loranthaceæ, in a parasitic form, represent the intervening step between the Coniferæ and the higher families.

I have also published some observations on the formation of the seeds of *Viscum album*†. The Polyembryony so often observed in the seeds of this plant is caused by the appearance of several embryo-sacs together, only one of which, however, usually becomes fully developed, while the others are abortive; I could not observe anything confirmatory of the statement of M. Decaisne, viz. that the embryo in this plant consists of several single embryos grown together. It is by no means seldom that several embryo-sacs contained in the same nucleus are fertilized, but six or eight weeks afterwards only one of them comes to perfect development;

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and therefore the doubling or trebling of the radicular end of the embryo of *Viscum* cannot be explained as owing to the cohesion of several embryos.

The structure of the female flower of *Viscum* is very simple; it consists of a single bottle-shaped nucleus, which is surrounded by a calyx-like organ, from which, at a later period, the white fleshy and gummy matter is produced which encloses the seeds and represents the pericarpium. In this calyx are inserted the leaves which may be held for petals; in the male flowers they are metamorphosed into anthers. In *Viscum* the nucleus is always situated on the apex of the principal or collateral axis; the end of it receives the pollen, and therefore takes the place of the micropyle; but in the base of the nucleus is formed the embryo-sac, which grows upwards into the cavity which has been formed in the nucleus; and therefore the embryo-sac is not developed in the point of the stalk, as M. Schleiden has stated, but just as usual, in the interior of the nucleus. I could never observe the fecundation by means of pollen-tubes; but directly after fecundation the embryo-sac becomes divided by means of partitions into a number of large cells, in which, at a later period, the albuminous body is formed. The embryo remains four or five weeks in the first stage of development in form of a small vesicle in the top cell of the embryo-sac, and when almost all the cells have produced albumen, it increases with great rapidity, and breaks through all the partitions of the embryo-sac from the top downwards. A series of drawings is annexed to the Memoir, and will give the requisite explanation.

Towards the end of the year I was fortunate enough to find a specimen of misseltoe which had two embryos in almost every one of the numerous seeds, which germinated very well when laid on the moist window-frame. There were the same number of rootlets as of perfect embryos in the seed, and the embryos were generally a little conjoined at their cotyledon end, but a complete cohesion never took place. The curious position which the embryos in the misseltoe seeds assume when there are several together, may be explained by the growing together of the albuminous bodies and by their peculiar form. Each embryo is formed in the axis of its own albuminous body, which at the micropyle end becomes ten or fifteen times thicker than at the lower end; and therefore, when their edges grow together, their axes must form an angle with each other, which varies from 40° to 60°.

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M. Horkel* read a treatise in the Academy of Sciences of Berlin concerning the Polyembryony of the Coniferæ; his own researches on this subject agreed perfectly with those of Robert Brown. In 1819 he had observed the small cavities which appear in the end of the albumen of *Abies excelsa*; and in the seed of *Pinus Cembra* he observed, together with the embryo, two abortive rudiments. In *Abies excelsa* M. Horkel observed the rudiments of the ovula assume that form in which Robert Brown has called them "Funiculi;" they lay in the middle of the great cavities of the albumen, parallel to each other, generally three together, seldom four; but M. Schleiden has observed six rudiments in *Pinus echinata.* In *Taxus baccata* M. H. never saw fewer than two rudiments, but generally three; but sometimes there is only one cavity in the apex of the albumen. In the Cupressineæ M. Horkel always found only one cavity for the formation of the embryo, lying in the axis of the albumen, but always two or four pollen-tubes entered the cavity; the Polyembryony of these plants may therefore be ranked with that of *Citrus*; it is, however, not so accidental, but belongs more to their nature.

M. Decaisne† has published some interesting researches on the structure and fecundation of the ovulum of "Thesium," which confirm the opinion I gave of Griffiths's description of the structure of the seeds of *Santalum album* (former Report, p. 33). A short time after fecundation has taken place a tube (Schlauch) is seen to proceed out of the ovulum; this tube connects itself with another very fine one which descends into the cavity of the ovulum from above. After the combination of these two has taken place, the tube swells and assumes the form of a bladder, the lower part becomes filled with cells. This tube is the embryo-sac, in the top part of which the embryo is formed in shape of a small round bladder; and what is most remarkable is, that it is quite naked, and therefore lies outside the nucleus (we have already shown that this is also the case with Leguminosæ, where however the embryo-sac is enclosed in tunics (Eyhüllen, M.)); and that the seed is also naked, only covered by the thin membrane of the embryo-sac. During this formation of the embryo one observes that a simple tube is formed, which is digitate at the bottom and swollen at the apex; the column pierces this bag, in the centre of which it is enclosed, towards the point of insertion of the impregnated ovulum, and places

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M. Emil Kratzmann*, in his inaugural dissertation, has treated of the seeds of plants; and although he remarks in the introduction, that his work is only a compilation and does not pretend to originality, still I cannot but recommend this carefully compiled and complete paper to all those who have not access to the larger botanical works. The treatise is divided into five parts; namely, of the præformation-stadium of the seed, of its production and formation, its evolution (ripening), then of the structure of the ripe seed, etc., and lastly of the circumstances under which the germination of the seed takes place.

M. Adrien de Jussieu† has published a very interesting research on the embryos of the Monocotyledons: after an historical introduction he gives the general characters of the monocotyledonous embryos, and then proceeds to the enumeration of the peculiarities exhibited by the embryos of the different genera. The most common form of the monocotyledonous embryo is either that of a cylinder with rounded ends, or of a more or less lengthened ellipsoid. Sometimes the cotyledon end is broader; sometimes, and indeed more frequently, the radicular end is enlarged; often the small blunt point on the radicular end, at which the suspensor terminates, remains, but before the ripening of the embryo it always projects. The position of the bud (Knöspchen) is determined by that of the rootlet; it appears as a small prominence at one side of the circumference; this projection is seen in the cotyledonar fissure. In rare cases this cleft is opened its whole length, and its sides allow the first leaflets of the bud to be visible throughout their whole length, as in the case of *Ouvirandra.* In other cases the sides of the clefts touch in the middle, and separate both upwards and downwards; and in this case the apex of itself with its swollen end (in the form of a retort) over one of the apices of the sac of the neighbouring embryo. M. Decaisne considers this peculiar tube to be a nutritive vessel, which replaces at the same time the chalaza; and I myself believe (although I have not examined the subject) that this tube is either directly produced out of the end of the pollen-tube, as in the case of *Mesembryanthemum linguæforme*, or that it is a peculiar formation of the embryo-supporter, as in *Ceratophyllum*, etc.

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* Die Lehre vom Saamen der Pflanzen. Mit 4 lithographeiten Tafeln. Prag. 1839. 8.

† Sur les Embryons monocotylédones.—Lu à l'Académie des Sciences dans le séance du 1 Juillet 1839; Ann. des Sciences Naturelles, Part. Bot. 1839, i. 341—361.

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M. Adrien de Jussieu† has published a very interesting research on the embryos of the Monocotyledons: after an historical introduction he gives the general characters of the monocotyledonous embryos, and then proceeds to the enumeration of the peculiarities exhibited by the embryos of the different genera. The most common form of the monocotyledonous embryo is either that of a cylinder with rounded ends, or of a more or less lengthened ellipsoid. Sometimes the cotyledon end is broader; sometimes, and indeed more frequently, the radicular end is enlarged; often the small blunt point on the radicular end, at which the suspensor terminates, remains, but before the ripening of the embryo it always projects. The position of the bud (Knöspchen) is determined by that of the rootlet; it appears as a small prominence at one side of the circumference; this projection is seen in the cotyledonar fissure. In rare cases this cleft is opened its whole length, and its sides allow the first leaflets of the bud to be visible throughout their whole length, as in the case of *Ouvirandra*. In other cases the sides of the clefts touch in the middle, and separate both upwards and downwards; and in this case the apex of itself with its swollen end (in the form of a retort) over one of the apices of the sac of the neighbouring embryo. M. Decaisne considers this peculiar tube to be a nutritive vessel, which replaces at the same time the chalaza; and I myself believe (although I have not examined the subject) that this tube is either directly produced out of the end of the pollen-tube, as in the case of *Mesembryanthemum linguæforme*, or that it is a peculiar formation of the embryo-supporter, as in *Ceratophyllum*, etc.

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* Die Lehre vom Saamen der Pflanzen. Mit 4 lithographeiten Tafeln. Prag. 1839. 8.

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the blossom comes out through one of the openings (the upper one), as in *Aponogeton distachys,* etc., or as in *Sparganium ramosum, Commelina tuberosa,* etc., where no trace of it is seen. In most cases the sides of the cleft are connected the whole length, and the cleft appears then as a line, which is either straight or curved; a transverse section then shows the position of the edges of the cleft. All these cases are fully explained by a series of beautiful delineations. The little bud appears in the form of a small wart at the bottom of a circular, oval or lozenge-shaped frame (Einfassung); in *Amaryllis carnea* the edges of the cleft are open only above, and the rest of their length they are grown together. The cleft appears horizontal (*Veratrum*), and when the edges become lengthened it acquires the appearance of a divided or even of a simple ligula, according as the inner edges are more or less perfectly connated. In *Rajania hastata* and *Tamus communis* the inner edges remain free. Finally, says M. de Jussieu, the destruction of the continuity in the cotyledon end of the embryo can sink to a mere point, as is very frequently the case in the Gramineæ and Cyperaceæ, or this point may entirely escape observation; however, all these modifications are only different degrees of the same organization. As one may draw a conclusion concerning the position of the bud from the position of the cleft, one soon observes the relation existing between the cotyledon and the radicle end; the former is often much larger than the latter.

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M. de Jussieu then proceeds to the examination of Lindley's theory, according to which the monocotyledonous embryo may be considered as a dicotyledonous, from which one cotyledon has disappeared, and the other has wound itself round the plumula and grown together at the edges. M. de Jussieu brings forward a number of interesting observations in opposition to this theory, and arrives at the result that the monocotyledonous embryo, as far as regards its cotyledon part, may be perfectly compared to a bud. Finally, the variable forms which the monocotyledonous embryos assume are considered; and the author concludes, that the stem of some monocotyledonous embryos has a disproportionate excrescence on one side, which has to a certain extent the appearance of a cotyledon, and performs its functions, particularly in such cases where the true cotyledon is imperfect, and reduced to the state of a mere case or sheath. It is to be expected, that this subject, treated of by M. de Jussieu, will shortly receive its perfect solution; it is however a gigantic work to examine the genesis of all the above-mentioned monocotyledonous embryos, particularly as it appears that the formation of the cotyledon is

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different in various families. I here refer to what I have observed of its formation in *Maïs.*

In the Botanical Society of Edinburgh* Mr. Giraud read a treatise on the structure and function of the pollen, from which it appears that he has arrived at the same results as have been published in the modern German works on this subject. In *Crocus vernus* Mr. Giraud saw three pollen tunics; and on the surface of the pollen grains of *Polemonium cœruleum* he found small opake particles, which exhibited a peculiar motion as soon as put into water. The grooves which are found on some spherical and ellipsoidal pollen grains do not appear to Mr. Giraud to be clefts in the outer membrane. The chemical examination of pollen showed the presence of potash in the pollen of *Antirrhinum majus*, as also of acicular crystals of phosphate of lime, etc., etc. Mr. Giraud found also that warmth assists the formation of the pollen-tubes.

In the 'Botanical Register' † is a note on the appearance of amylum on the surface of the pollen grains of *Polemonium cœruleum*, the formation of which is derived from the primitive cells (Mutterzellen). [The presence of amylum, if it be really true, can only be considered as an exception to the rule and as unimportant, for it is by no means general.—*Meyen.*]

At the meeting of Naturalists at Freiburg M. A. Braun ‡ made known his observations on the arrangement in the bursting of the anthers; he proved that the order in which the anthers open agrees only in few cases with the genetic succession of the stamina, indeed is sometimes just the contrary; but in most cases where a real succession takes place, it stands in no relation to the genesis. From a great number of observations M. Braun draws the following cases, in which the order of the opening of the anthers appears:—

I. Simultaneous opening of all the anthers. II. Cyclous-successive opening, and either in centripetal or centrifugal succession. III. One after the other (gliederweise) successive opening; this takes place, 1. in spiral succession, (*a.*) centripetal or progressive, (*b.*) centrifugal or regressive, (*c.*) from the central region, passing either forwards or backwards, and (*d.*) in a determinate spiral, etc., or, 2. the opening does not take place in spiral succession. Here it passes regularly from one side of the flower to the other, or in an apparently irregular but still constant succession.

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Treffz is said to have made known several instances of this "twofold ennobling" in the 'Taschenbuch für Natur- und Gartenfreunde' for 1803, from which it appeared that apple-trees which had been twice ennobled were distinguished from trees of the same kind by the excellence of their fruit. Currants and gooseberries gave excellent fruit after the first, but more especially after the third and fourth ennobling. More striking is the effect of such an ennobling in the case of the apricot and quince: the apricot, which has a dry flesh, was planted on a green Reineclaude; the quince, which in its raw state is not eatable, was put on an excellent autumnal bergamot pear. Treffz relates of the apricot, that the branch, on account of its excessive luxuriance, only bore fruit in the fifth year; but one as juicy as the Reineclaude, of a more reddish yellow colour and more delicate taste. The quince bore fruit in the third year, which became ripe in the beginning of September, and whose flesh, even in this first double ennobling, was much more tender, and free from hard parts.

I hereby bring this subject forward, and hope that more experiments may be instituted, and that those that have been already made may become more generally known. The above observations do not prove the usefulness of the double ennobling, but appear to prove that the nature of the graft is changed by the subject; for bad fruits were grafted on good ones (which is not generally the case), and better fruit was obtained.

[To be continued.]

XXII.—*Notes on Birds.* By T. C. Eyton, Esq., F.L.S., &c.

No. 2.

Bizeura lobata, Shaw.

Integuments very thick and strong. Tongue large, broad and thick, with an appendage at the tip, such as is generally found in Ducks; a deep groove down the centre, and two others placed so that their points meet towards the tip, and diverge as they continue backwards, forming a chevron; a lunate groove placed transversely near the middle of the tongue; the horns turned backwards. The

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